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ABSTRACT

The Stanford Research Institute (SRI) Classroom Observation Instrument was modified to study individual teaching configurations (teaching methods and styles) in adapting a criterion-referenced mathematics curriculum in grades 2, 4, and 6. Ten configurations characterized 72% of the 168 teachers who were interviewed. Although all teachers taught and tested students on program objectives and recorded achievement immediately, the configurations differed by choice of instructional material, grouping technique, and use of test results and remediation. Fifty eight of these teachers were observed in the classroom to identify differences between classrooms and between the 10 dominant configurations. Although the program allowed teachers to be flexible, most organized their classrooms around large group instruction and paper-pencil activity. Significant configuration differences were found for 25% of the Classroom Checklist variables, and 12% of the Five Minute Observation variables. The impact of the configurations on student achievement could not be determined because test data was not available, although research indicates that achievement is depressed if class management takes too much time. (CP)

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THE ADAPTATION OF THE STANFORD RESEARCH INSTITUTE CLASSROOM OBSERVATION INSTRUMENT FOR USE IN STUDYING TEACHER VARIATIONS IN INNOVATION IMPLEMENTATION

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THE ADAPTATION OF THE STANFORD RESEARCH INSTITUTE CLASSROOM OBSERVATION INSTRUMENT FOR USE IN STUDYING TEACHER VARIATIONS IN INNOVATION IMPLEMENTATION[1,2]

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Classroom observation has long been used to study teaching behavior. A multitude of observation systems have been developed that focus on every conceivable facet of the act of teaching. In the last several years researchers have made great strides in identifying effective teaching behaviors by correlating data collected in systematic classroom observation with a variety of outcome measures (Brophy & Evertson, 1976; Good & Grouws, 1975; McDonald, 1976).

More recently researchers studying the phenomenon of innovation implementation have begun to use classroom observation to measure the extent of use of a particular innovation (Evans & Scheffler, 1974; Gross, Giacquinta & Bernstein, 1971; Stallings & Kaskowitz, 1974). The Procedures for Adopting

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[1]Paper presented at the annual meeting of the American Educational Research Association, Toronto, March 30, 1978.

[2]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the author and do not necessarily reflect the position or policy of the National Institute of Education, and no endorsement by the National Institute of Education should be inferred.

Education Innovations (PAEI) Project at the Texas Research and Development Center for Teacher Education has spent the past three and a half years studying closely the individual as s/he experiences innovation implementation. Since direct classroom observation can only detect a fraction of the behaviors of individual adopters, and is not useful in attending to the feelings and attitudes of adopters, it has been little used in project research to date.[3] However, as more interest has focused on the changes made to innovations by users, classroom data has appeared more appropriate. This paper describes the use of a modified version of the Stanford Research Institute's Classroom Observation Instrument to study user adaptations of an innovation made during the implementation process.

Overview of the Study

For the past three and a half years the PAEI Project has focused on the development and verification of the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973). The CBAM describes innovation adoption and implementation from the individual's point of view as a developmental process entailing change in "concerns about" the innovation and use of it. A series of cross-sectional and longitudinal studies (Hall & Loucks, 1977b; Hall & Rutherford, 1976) have indicated that the two dimensions, Stages of Concern About the Innovation (Hall, George & Rutherford, 1977) and Levels of Use of the Innovation (Hall, Loucks, Rutherford & Newlove, 1975) are useful concepts for describing individuals' progress in implementing innovations over time.

From the beginning of this research, it has been clear that not only do individuals' attitudes about and use of an innovation change over time, but that users may also change the innovation itself. In studies focusing on users of various process and product innovations, the same innovation looked very

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[3]The one instance of the use of classroom observation was in an ethnographic study conducted to validate the interview procedure that measures Levels of Use of the Innovation (Hall & Loucks, 1977a).

different from classroom to classroom and from institution to institution (Hall & Loucks, 1978). Other researchers, such as those of the Rand Corporation (Berman & McLaughlin, 1975), have also found user adaptations to be common. The different patterns of use of an innovation that result from user adaptations have been labeled "configurations" by the Texas project.

Because of the obvious significance of innovation configurations, a study was initiated in 1976 to learn more about the phenomenon. Among the objectives of this study were a more complete conceptualization of configurations and a procedure for identifying configurations of a given innovation. Another objective, the focus of this paper, was to explore the relationships between identified configurations of the innovation under study and the classroom teaching behaviors and classroom organization patterns of the teachers using these configurations.

In pursuit of this latter objective, the Stanford Research Institute Classroom Observation Instrument (Stallings & Kaskowitz, 1974) was used, modified significantly, to provide as rich a picture as possible of the actual classroom use of the innovation. This paper first describes the study of configurations in order to provide the reader a context within which to understand the use of classroom observation data. The paper then describes the modifications made in the Stanford instrument, reports selected findings that contribute to the concept of configurations, and draws implications for researchers, facilitators and evaluators of change efforts.

Innovation Configurations

The Concept of Configurations

Previous research by the PAEI Project indicated that users of the innovations studied had modified them and several distinct configurations of each innovation could be distinguished (Hall & Loucks, 1978). For example, in a longitudinal study of team teaching, nine different configurations of the innovation were

discovered, ranging from teams that met everyday and shared children and instructional planning, through teams that met only for administrative purposes and shared resources, but had largely self-contained classrooms (Rutherford, 1977). It became clear that each innovation studied had its own set of characteristic configurations. The number of patterns found could be as many as the number of users studied. By focusing on similarities in adaptations to the innovation a "manageable" number of dominant configurations (nine or fewer) could be identified.

Every innovation is made up of components, which are the large parts or pieces of the innovation. For example, a particular curriculum might be described by these components: materials, teaching approach, grouping patterns, and testing procedures. Users can make adaptations within each component, creating differences called component variations. For example, variations for the component of materials could be text, teacher-made and manipulative materials. To identify the configurations that are exhibited by a sample of users, the components of the innovation and the variations within the components implemented by each user must be identified.

In early research by the PAEI Project, configurations were discovered almost serendipitously, then subsequently investigated through open-ended interview questions. When it was determined that the phenomenon of configurations was a significant part of change research, a more systematic way of identifying configurations was needed. Developing this systematic procedure, testing it, and documenting what was done was one objective of the configuration research.

Identifying Innovation Configurations

To identify configurations a five-step procedure was developed:

(1) The curriculum developers are asked to describe the

innovation and what it should look like when implemented. This provides an idea of innovation components.

(2) A small sample of users selected for probable diversity in use of the innovation are interviewed and observed to determine how they use the innovation. This adds any components (not envisioned by developers) which users may have included in their innovation use.

(3) A set of interview questions is developed based on the components derived from steps (1) and (2). A sample of users is interviewed about how they implement each component. The interview is sufficiently open-ended to elicit variations of the components, in addition to other components not noted previously.

(4) A checklist is constructed which lists components and the possible variations within each component. This checklist can be completed for each user from interview information or it can be completed directly by the user.

(5) Patterns of component variations are analyzed and combined to provide a manageable number of configurations. Users are assigned to configurations based on checklist responses.

During the 1976-77 school year, the concept of configurations with innovation components and variations within the components, and the five-step procedure for identifying configurations were applied in the study of a criterion-referenced mathematics curriculum.

The Target Innovation and Research Sample

The Innovation

To study configurations, a criterion-referenced mathematics curriculum

was selected that had been introduced into a large suburban school district three years previously. The curriculum was developed and pilot-tested by the school district. It consists of a set of objectives for grades K through 8, a series of tests to assess accomplishment of individual objectives and clusters of objectives, and a locally printed workbook with activities designed to assist teachers in teaching and reinforcing the objectives. Teachers are required to complete a record card for each child. The availability and use of other materials, such as textbooks, workbooks, and manipulative materials, vary from school to school and teacher to teacher. Instructional strategies are selected by teachers whose only requirements are to teach the objectives, test for the objectives, and keep records on pupils' accomplishment of the objectives.

Sample

The curriculum is taught in all grades in the more than eighty elementary schools in the district. These schools vary in size, organizational structure, scheduling of the school year, and community composition. With this variation among schools and the freedom given teachers to utilize their own instructional strategies, it was hypothesized that significant variation in configurations of the program would exist. For this study, nineteen schools were chosen with a range of school-level variables so that a wide variation in use of the curriculum might be represented. One hundred sixty-eight grade 2, 4, and 6 teachers participated.

As described above, innovation configurations are identified by interviewing users about variations of the program they use, and by completing a checklist based on these responses. However, it was thought that if more were known about the classroom behaviors related to specific configurations of the curriculum, additional insight might be gained into how these configurations actually

relate to classroom teaching as well as why teachers make the changes in the program that they do. This classroom data could also be used to do something rarely considered by change researchers - it could relate the implementation of a given innovation to some of the variables that teaching effects researchers are now agreeing do truly make a difference in children's learning (Medley, 1977; Rosenshine, 1977). The decision was made to supplement interview data with direct and systematic classroom observations of the implementation of the curriculum.

The decision to collect classroom observation data was easier to make than the decision about which of the numerous observation systems to use. The Stanford Research Institute's Classroom Observation Instrument (Stallings & Kaskowitz, 1974) was selected because it enables the collection of a wide range of data about the teaching/learning context as well as about the interactions of teachers and children. Since there was no way, initially, to determine which variables would differentiate teachers in the different configurations, a system that assessed as many variables as possible was required. It also required that the assessments be as systematic as possible, so that the large number of correlations necessary in such an exploratory study could be conducted.

The adaptability of the Stanford system was also important. It could easily be adapted for use with a single subject area such as math and for a short duration of teaching time. The categories of teacher-child interactions could be changed to insure the measurement of variables hypothesized to be important.

A final reason for selecting the Stanford instrument was that it was utilized previously in a successful study of innovation implementation (Stallings & Kaskowitz, 1974). Thus, results of this study could be related with minimal problems of comparability.

Adaptations of the SRI Classroom Observation System

The major changes made in the instrument used in Stallings' Follow Through studies were the result of the need to concentrate on one content area (mathematics), rather than on all teaching, and on one short period of the teaching day (math class), rather than on the entire teaching day. Three parts of the observation checklist, the Physical Environment Inventory, the Classroom Checklist, and the Five Minute Observation were modified. An SRI staff member served as a consultant to the PAEI staff modifying the instrument.

Physical Environment Inventory (PEI). This part of the system describes the classroom environment, the physical organization, and materials and equipment available and in use. Changes made in the PEI reflected possible arrangements and objects found in a classroom where math is taught, rather than all possible teaching materials and physical arrangements. The PEI is illustrated in Figure 1.

Classroom Checklist (CCL). The CCL takes a "snapshot" to describe what students and adults are doing in the classroom at a given point in time. The CCL used in the Follow Through study was a one-dimensional listing of activities with some materials noted. For this study the CCL was converted to a grid naming both the activities individuals could be involved in and the materials which could be used (Figure 2). Four numbered columns indicate the number of children involved in the activity (i.e., size of the group), whether those children are interacting with each other (I, interacting or N, noninteracting), the adult, if any, involved with the group (e.g., teacher, aide), and the nature of the adult's involvement (e.g., directing, participating). Another column indicates how many identical groups exist.

The materials and activities dimensions were generated to include the range

CCL

CLASSROOM CHECKLIST

Time started _____

MATERIAL

ACTIVITY		01 Textbook				02 Workbook Worksheet Paper				03 Test				04 Game Manipulative				05 Math Kit				06 AV Equipment Calculator Learning Machine				07 Overhead Chalkboard				08 Nonmath Material				09 No Material			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
01	Introduction to new material																																				
02	Reteach of previously introduced material																																				
03	Practice drill																																				
04	Going over problems or tests																																				
05	Testing																																				
06	Integrated instruction																																				
07	Nonmath learning activity																																				
08	Nonacademic social interaction																																				
09	Classroom management																																				
10	Transition																																				
11	Unoccupied child																																				
12	Discipline																																				

Figure 2.

Column 1: Number in group Column 2: T N Column 3: T A L I Column 4: D S P O X

that might exist in a math class. Nonmath as well as math activities are included. Using this grid, classroom organization and management of individuals can be described, as can be a variety of materials and grouping patterns. Changes in these variables can be noted as instruction progresses.

Figures 3 and 4 illustrate two different classroom arrangements as described by the CCL. In the classroom of Figure 3, four groups are at work. One group of six, directed by the teacher, is being introduced to a math concept on the blackboard. Another group of eight is taking a test supervised by an aide. Two other groups, one of five and the other of seven, are working at their seats on different teacher-prepared worksheets. Only these last two groups are interacting with each other about their work. Figure 4 illustrates a wholly different classroom arrangement, one in which all children are being introduced to the same material in the textbook by the teacher. Two children, although ostensibly involved in this activity, are "fooling around" with each other.

Five Minute Observation (FMO). The FMO section describes the moment-by-moment interactions that occur in the classroom and around a designated focal person, typically the teacher. Each message (verbal and nonverbal) is coded as to who originated it (e.g., teacher, child, large group of children), who received it, what the content was (e.g., question, response, praise), and how it was communicated (e.g., negative, accompanied by movement, while waiting). One frame of the FMO is coded for each action (see Figure 5).

For use in the present study, the FMO section was changed considerably from the original Follow Through version. Most of the modifications made for use in the Stanford R&D Center's experimental study of teaching effectiveness (Program on Teaching Effectiveness, 1977) were used, since they represented behaviors used in teaching basic skill areas which were known or suspected to

PRE

PREAMBLE

1. Focus person codes: 0 = the classroom teacher
   1-5 = child codes

   Focus person ___

2. Activity ___

3. Material ___

4. Continuation of previous activity? ___ yes ___ no

5. Number of children ___ ___

6. Teacher is:
   ___ 1. Directing
   ___ 2. Supervising
   ___ 3. Participating
   ___ 4. Observing
   ___ 5. Not involved

7. Time started ___ ___:___ ___

CCL

CLASSROOM CHECKLIST

Time started _____

ACTIVITY	MATERIAL 01 Textbook	02 Workbook Worksheet Paper	03 Test	04 Game Manipulative	05 Math Kit	06 AV Equipment Calculator Learning Machine	07 Overhead Chalkboard	08 Nonmath Material	09 No Material
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
01 Introduction to new material							6 N T D		
02 Reteach of previously introduced material									
03 Practice drill		5 I X 7 I X							
04 Going over problems or tests									
05 Testing			8 N A S						
06 Integrated instruction									
07 Nonmath learning activity									
08 Nonacademic social interaction									
09 Classroom management									
10 Transition									
11 Unoccupied child									
12 Discipline									

Figure 3

PRE

PREAMBLE

1. Focus person codes: 0 = the classroom teacher
   1-5 = child codes

   Focus person ___

2. Activity ___

3. Material ___

4. Continuation of previous activity? ___ yes ___ no

5. Number of children ___ ___

6. Teacher is:
   ___ 1. Directing
   ___ 2. Supervising
   ___ 3. Participating
   ___ 4. Observing
   ___ 5. Not involved

7. Time started ___ ___:___ ___

CCL

CLASSROOM CHECKLIST

Time started _____

MATERIAL

ACTIVITY	01 Textbook	02 Workbook Worksheet Paper	03 Test	04 Game Manipulative	05 Math Kit	06 AV Equipment Calculator Learning Machine	07 Overhead Chalkboard	08 Nonmath Material	09 No Material
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
01 Introduction to new material	28 N T D								
02 Reteach of previously introduced material									
03 Practice drill									
04 Going over problems or tests									
05 Testing									
06 Integrated instruction									
07 Nonmath learning activity									
08 Nonacademic social interaction	2 I T D								
09 Classroom management									
10 Transition									
11 Unoccupied child									
12 Discipline									

Column 1: Number in group Column 2: I N Column 3: T A U i Column 4: P S P O X

Figure 4

Figure 5
Five Minute Observation

1	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

2	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

3	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

4	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

5	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

6	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

7	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

8	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

9	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

10	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

11	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

12	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

13	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

14	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

15	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

16	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

17	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

18	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

19	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

20	Who	Whom	What	How
R	T A V	T A V	1 2 3 4 5	U O W
S	C D 2	C D 2	6 7 8 9 10	H N F T
C	S M L W	S M L W	11 12 S X	Q G I A B

to contribute to achievement gains. In the modified FMO section, for example, is is possible to identify interaction series, such as teacher responses to student statements that were responses to teacher questions. Several kinds of teacher feedback may be coded, including praise, process feedback, and corrective feedback. Additional modifications of the FMO codes were made for the present study, including the addition of a code for waiting. Figure 6 lists the codes for the modified FMO.

Observer Training and Reliability

Six substitute teachers who were local to the field site and had some knowledge of the mathematics curriculum and the schools were recruited to be classroom observers. Training was conducted by the SRI staff member who had participated in initial development of the measure and had been a consultant on the modifications made for the present study. Training lasted for seven full days and involved memorizing the codes, extensive practice coding of written dialogues and videotape, discussions, and several classroom practice sessions.

In their development of the instrument and Follow Through implementation study, SRI researchers utilized a variety of methods to establish reliability. These included establishing a reliability for each code and confusability of coding studies (Stallings & Kaskowitz, 1974). Since this initial work, trainers measure interobserver reliability as the percent of codes used correctly by each observer when coding six stop-action videotapes. Seventy percent is considered acceptable. For the present study, observer reliabilities ranged from 78% to 90%.

Procedure

Identification of Configurations of the Math Program

The first step in the study of the math program was to identify the

Figure 6

LIST OF FMO CODES

THE WHO AND WHOM COLUMNS

T = Teacher
A = Adult
V = Volunteer Child
C = Child
D = Different Child
2 = Two Children
S = Small Group
M = Medium Group
L = Large Group
W = Whole Class

THE WHAT COLUMN

1 = Command or Request
1Q = Direct Question
2 = Open-Ended Question
3 = Response
4 = Instruction, Explanation
5 = General Comment/General Action
6 = Task-Related Statement/Action
7 = Acknowledge
8 = Praise
9 = Corrective Feedback
10 = Process Feedback
11 = No Response, Don't Know
12 = Observing/Listening

S = Silent
X = Movement

THE HOW COLUMN

U = Utilitarian
O = Organizing, Structuring
W = Waiting
H = Happy
N = Negative
F = Feelings
T = Touch
Q = Question
G = Guidance
I = Incorrect Response

A = Academic
B = Behavior

configurations used by the teachers. The following steps, parallel to the five steps described previously, were followed:

(1) Math department staff who developed the curriculum were interviewed for an initial program description.

(2) In the spring of 1976 a sample of teachers in two widely different schools were interviewed and observed.

(3) Based on these open-ended interviews and observations, a set of interview questions and probes were developed. A sample of 168 teachers was interviewed in the fall of 1976.

(4) Teachers' responses resulted in the checklist in Figure 7, completed for each teacher by the interviewer. Five innovation components were identified, with several possible variations for each.

(5) Analysis and reduction of checklist data resulted in the identification of eight configuration patterns, described in Figure 8, which accounted for 59% of the teachers in the sample. (Most of those unaccounted for had an "other" response for a component and so did not fit into a pattern.)

Subsequent teacher interviews resulted in refinement of the checklist, particularly in the component variations. The refined checklist (Figure 9) was completed by teachers in the spring of 1977. Five additional configuration patterns were identified (see Figure 10). At that time, however, there were insufficient numbers of teachers representing three of the configuration patterns identified in the fall. Ten patterns accounted for 72% of the teachers.

Selection of the Subsample for Classroom Observation

A subsample of 58 teachers was selected from the larger sample of 168

CONFIGURATION CHECKLIST: MATH PROGRAM

Teacher I.D. _____

School I.D. _____

Grade _____

FOR EACH OF THE FIVE DIMENSIONS BELOW, CHECK THE ONE THAT MOST CLOSELY DESCRIBES THE TEACHER. IF NONE DESCRIBE THE TEACHER, USE THE SPACE ON PAGE 2 UNDER THE APPROPRIATE DIMENSION TO DESCRIBE THE SITUATION IN DETAIL.

1. Instructional resources used

___ Program materials only
___ Textbook only
___ Textbook emphasized, Program materials supplemental
___ Program materials emphasized, textbook supplemental
___ Enriched combination, including such sources as games, manipulative materials, learning centers, etc., as well as the above
___ Unknown
___ Other -- describe on page 2

2. Grouping patterns

___ Large group within heterogeneous classroom: whole class or two large groups
___ Large group within homogeneous classroom: whole class or two large groups
___ Small stable groups
___ Small flexible groups
___ Unknown
___ Other -- describe on page 2

3. Program objectives used largely in sequence as guide for instruction

___ yes ___ No ___ Unknown ___ Other -- describe on page 2

4. Kind of testing

___ Posttest on objectives (either program-supplied or teacher-made) and cluster test (either program-supplied or teacher-made)
___ Cluster test only (either program-supplied or teacher-made)
___ Teacher observation only
___ Unknown
___ Other -- describe on page 2

5. Test utilization

___ Test results determine what is to be taught next to each individual
___ Group goes on if most pass test; stragglers are given special attention
___ Group goes on if most pass test; those who fail are not attended to
___ Unknown
___ Other -- describe on page 2

Figure 8

Configuration Patterns for the Math Program
Fall 1976

Commonalities: All configuration patterns have the following elements in common:

Objectives:	Program objectives are taught
Testing:	Students are evaluated on their achievement of program objectives
Record Keeping:	Teachers record achievement or non-achievement of program objectives immediately after evaluation occurs

Configuration Patterns:

A (N = 11)	Materials:	Program materials emphasized
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
B (N = 34)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
C (N = 16)	Materials:	Enriched combination
	Grouping:	Small flexible groups
	Test Use:	Test results determine next steps for individual
D (N = 14)	Materials:	Enriched combination
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individual
E (N = 8)	Materials:	Program materials emphasized
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individuals
F (N = 6)	Materials:	Textbook emphasized
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
G (N = 5)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, stragglers not attended to
H (N = 5)	Materials:	Program materials emphasized
	Grouping:	Large group(s) within heterogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers

Figure 9

MATH CHECKLIST #2

I.D. (Last 4 digits of SS#) _____ _____ _____ _____

Please check one choice under each of the five categories below that is the most descriptive of your math instruction.

1. Instructional resources used:

_____ Program materials (i.e., packets, worksheets) only
_____ Textbook(s) only
_____ Textbook(s) emphasized, program materials supplemental
_____ Program materials emphasized, textbook(s) supplemental
_____ Combination of text(s) and/or program materials with teacher-made materials and games
_____ Large variety of text(s), program materials, games, teacher-made materials, manipulatives, centers, labs, etc.

2. Grouping patterns:

_____ Teach whole class or two groups in a class with children ranging in abilities (i.e., heterogeneous)
_____ Teach whole class or two groups in a class with children of generally the same abilities (i.e., homogeneous)
_____ Teach 3 or more small groups that are fairly stable--the children in each group seldom move to a different group
_____ Teach 3 or more small groups that change continually--the children frequently move to a different group.
_____ Teach individuals only, no grouping

3. Clusters of objectives:

_____ Use program clusters largely in sequence as a framework for instruction
_____ Use program clusters largely out of sequence
_____ Do not use program clusters

4. Objectives:

_____ Use program objectives largely in sequence within the clusters
_____ Use objectives largely out of sequence
_____ Do not use program objectives

5. Kind of testing:

_____ Use posttest on objectives (either program-supplied or teacher-made) and cluster test (either program-supplied or teacher-made)
_____ Use cluster test (either program-supplied or teacher-made) only
_____ Use posttest on objectives (either program-supplied or teacher-made) only
_____ Use teacher judgement only
_____ Varies widely using posttests, cluster tests and/or teacher judgement

6. The use of test results:

_____ Each individual child is assigned work or activity depending on the results of the test given
_____ When most of the group passes a test the group goes on; those who fail are given special attention
_____ When most of the group passes a test the group goes on; those who fail will have another chance to learn later due to the spiral nature of the curriculum
_____ What is done with test results depends on the objectives being taught

ARE THERE OTHER SIGNIFICANT FEATURES OF YOUR MATH PROGRAM THAT WE HAVE NOT INCLUDED? (Please describe on back of this page)

Figure 10

Configuration Patterns for Math Program
Spring 1976

Commonalities: All configuration patterns have the following elements in common:

Objectives:	Program objectives are taught
Testing:	Students are evaluated on their achievement of program objectives
Record Keeping:	Teachers record achievement or nonachievement of program objectives immediately after evaluation occurs

Configuration Patterns:

A*		
B (N = 34)	Materials:	Enriched combination
	Grouping:	Large group(s) with homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
C (N = 5)	Materials:	Enriched combination
	Grouping:	Small flexible groups
	Test Use:	Test results determine next steps for individual
D (N = 6)	Materials:	Enriched combination
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individual
E (N = 9)	Materials:	Program materials emphasized
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individual
F*		
G (N = 18)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, stragglers not attended to
H*		
I (N = 16)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Depends on objectives being taught
J (N = 7)	Materials:	Enriched combination
	Grouping:	Large group(s) within heterogeneous classroom
	Test Use:	Group goes on if most pass test, stragglers not attended to
K (N = 7)	Materials:	Enriched combination
	Grouping:	Small stable groups
	Test Use:	Depends on objectives being taught
L (N = 6)	Materials:	Enriched combination
	Grouping:	Small flexible groups
	Test Use:	Group goes on if most pass test, stragglers not attended to
M (N = 5)	Materials:	Enriched combination
	Grouping:	Small stable groups
	Test Use:	Group goes on if most pass test, attention to stragglers

Total = 113 out of 158

*Configurations A, F and H decreased to less than 5 individuals each in the spring.

teachers to be observed in the classroom.

Use of the Observation System

Observations were conducted in the same classrooms twice during the study, once in February and again in May. Of the 58 teachers observed in February, 50 were observed again in May. Those eight who dropped out were either no longer teaching or were no longer routinely teaching math.

Math classes were found to range in length from thirty to sixty minutes. Since the entire class period was to be observed, observers arrived approximately ten minutes before class and completed the Physical Environment Inventory. When class officially started, time was noted, a Classroom Checklist was completed, and a Five Minute Observation was intitiated. This series of activities took between six and ten minutes. Ten minutes after the first Classroom Checklist was initiated, the second series of activities commenced, beginning with the second CCL. Thus, every ten minutes a CCL and an FMO was completed until the math class ended.

The first two Five Minute Observations were completed using the teacher as the focal person of the interactions. The third FMO focused on an individual child who was chosen by a random selection procedure established during training. The fourth and fifth FMO's returned to the teacher as focus, and the sixth, if time allowed, focused on another randomly selected child. Thus, teacher- and child-focused interaction data were available for each classroom observed.

Research Questions and Analysis

Preliminary analysis of the classroom observation data has been conducted to respond to three general research questions:

(1) What variations exist within the sample in teaching behavior, classroom organization, and student behavior?

(2) How do dominant configurations differ in terms of actual classroom behavior and organization?

(3) What is the relationship between the configurations of the math program and the variables that teaching effects research suggests significantly affect achievement?

To respond to these questions, Classroom Checklist and teacher-focused Five Minute Observation data were used. For the CCL, 48 variables were identified for analysis. These included the twelve activities, nine material types and twenty-seven additional variables such as the role of the adult and the interaction/noninteraction of students. For the FMO, 128 variables were adapted from those used in the Stallings and Kaskowitz Follow Through Study (1974). Of the over 100,000 possible combinations of FMO codes, these 128 variables were considered to have relevance to the present study. Examples of these variables are "teacher to child direct question," "child to teacher response," and "child self-instruction." As noted in more detail in the next section, frequency distributions and analyses of variance of the CCL and teacher-focus FMO variables were conducted for each observation period.

Although teachers were initially selected for observation based on the configuration patterns assessed using the first checklist (Figure 7), analyses of the data were conducted using the configuration pattern assessed by the second checklist (Figure 9). This was because the second checklist was completed in April and was more likely to represent teachers' configurations in the second term than would a checklist completed in September (i.e., the first checklist). Six of the ten configurations identified using the second checklist (patterns B,C,D,E,G, and I) contained three or more teachers in the observation sample, so these were selected for comparative analysis. The number of teachers

in each configuration pattern for both data collection periods is reported in Table 1.

Table 1

Number of Teachers Observed

	B	C	D	E	G	I	Total
February	14	3	5	7	4	7	40
May	12	3	5	7	3	3	33

Discussion

Preliminary analysis of the classroom observation data has begun to provide some insights into the implementation of the math program and to acknowledge the value of using this observation system to look in-depth at innovation implementation. This section describes some of the analyses that have been done to date and some of the tentative findings suggesting responses to the three basic research questions.

Research Question 1: What Variations Exist Within the Sample in Teaching Behavior, Classroom Organization and Student Behavior?

This particular criterion-referenced mathematics program allows teachers a great deal of variation in how they actually teach. Requirements are few and deal largely with what is to be taught (i.e., the stated objectives), rather than how to teach and organize for instruction. It is of interest to note, three years after initial introduction, how much variation actually occurs among teachers using the program. The observation data reveals which behaviors and organizational patterns vary the most and which occur rarely or not at all.

To respond to the first research question, distribution statistics were analyzed for the sample as a whole. Results suggest that there is more consistency than difference among teachers. One indication of this is that the mode for 89% (February) and 90% (May) of the variables analyzed was the same:

zero. This suggests that teachers consistently do not demonstrate these behaviors in their teaching and organization of the classroom.

Another interesting occurrence is that 16% (February) and 28% (May) of the variables were never observed. For example, adults other than teachers were never found (February or May) to act in a participating role with students; rather, they either directed, supervised or observed (CCL). During Five Minute Observations, teachers were never observed giving neutral or positive corrective feedback to students that related to math (negative corrective feedback was observed).

Although many behaviors were infrequently or never observed, some were frequently observed. For the Classroom Checklist, for example, the mean frequency for all the variables was 2.11 (February) and 2.12 (May). (For the Classroom Checklist, the mean is defined as the average number of children involved in that variable per checklist.) Several CCL variables, however, had mean frequencies of over 10.0, as noted in Table 2.

Table 2

Checklist Variables with High Frequencies

	Variable	February Mean	May Mean
V4	Number of students in noninteracting groups	21.19	19.71
ACT3	Activity involving practice, drill	13.30	12.92
MAT2	Use of workbook, worksheet or other paper	11.78	13.16

Several interesting observations can also be made from studying the mean frequencies for the Five Minute Observation data. (For the FMO, the mean is defined as the percent of interactions or frames that represented that variable out of all the interactions (frames) that were recorded.) Here, comparing the mean for each variable with the mean for all variables is less meaningful than for the CCL, since the varibles are not mutually exclusive (e.g., one variable, "child open-ended question to adult," is a subset of another variable, "child

question to adult"). However, noting some dominant trends is useful. For example, for February data, there are twice as many adult to child verbalizations ($\bar{x}$ = 50.06) as child to adult verbalizations ($\bar{x}$ = 20.58). Another item of interest in the February data is that the most frequent adult communication/attention focus is one child ($\bar{x}$ = 38.96) and next frequent is the whole class ($\bar{x}$ = 12.39). Very infrequently is the focus on a small group ($\bar{x}$ = 2.72). A significant number of interactions involved in an adult directly instructing in math ($\bar{x}$ = 13.89 for February data).

Research Question 1 focused on the variations that existed in teachers' classroom behavior. However, the findings suggest more similarities than differences. A typical math class for this sample would likely have large group instruction with students not interacting with each other. Children work largely on paper/pencil practice activities. Teachers talk more than children, with a significant part of their talking being instructional. Much of their talk is directed at an individual child, although large group instruction prevails.

Research Question 2: How Do Dominant Configurations Differ in Terms of Actual Classroom Behavior and Organization?

As noted earlier, configurations of the math program were derived from interview data and the teacher-completed checklist. When analyzed according to configuration, the observation data describe behaviors of teachers and students which characterize each configuration and which distinguish configurations from each other; that is, the data suggest whether there are differences between configurations that are reflected in classroom behavior.

As noted previously, although a great deal of variation existed in the configurations used by teachers, there appeared to be a cluster of six dominant configurations. In order to characterize these configurations and distinguish

them in terms of observation variables, analyses of variance were conducted for each of the CCL and FMO variables. Significant differences ($p < .10$, as this was an exploratory study) were found for 12 CCL variables (25% of the variables analyzed) in February and 12 CCL variables (25%) in May; and 21 FMO variables (15%) in February and 12 FMO (9%) in May. Post hoc Duncan's Multiple Range tests were conducted to determine which configurations were actually different.

Analysis of the behaviors that were significantly different for different configurations revealed several interesting tendencies. First, one-third of the significant differences occur for behaviors that would be expected to differentiate the configurations, and so, in a sense, validate the patterns. Checklist data, for example, indicate that students are working in more different activities in configurations C, D, and E (small group and individualized settings) than in configurations B, G, and I (large group instructional settings). The teacher directs larger numbers of students in configurations B, G, and I than in configurations C, D, and E. The teacher acts in a supervisiory role more often in configurations C, D, and E than in configurations B, G, and I.

Five Minute Observation data also indicate differences in configurations which were expected. Adults instruct individual children more frequently in configurations C, D, and E than in configurations B, G, and I, and conversely instruct groups more frequently in configurations B, G, and I than in configurations C, D, and E. Individual children interact verbally with adults more often in configurations D and E than in configurations B, G, and I.

Figure 11 lists behaviors that are characteristic of each configuration, i.e., that teachers of the particular configuration(s) appear to exhibit at any one data collection period more than teachers of some other configurations. Note again that many of the behaviors reflect characteristics expected for the given configuration. In addition, some other tendencies exist. For example,

Figure 11

Characteristic Behaviors By Configuration

Configuration B

- Teacher directs larger number of students
- More students involved in a reteach of previously introduced material
- More adult commands, requests on direct questions to groups of students both related and unrelated to math
- More group instruction
- More adult task-related comments to students
- The whole class is more often the adult communication focus
- More student responses related to math.

Configuration C

- Larger number of groups that do not interact among themselves (note: a group is defined as two or more students working on the same material and activity)
- Teacher more frequently in a participating role with more students
- Teacher more frequently in observing role
- Adult more frequently in a directing role
- Adult more frequently in a supervisory role
- More students involved in going over problems or tests
- More students involved in a nonmath learning activity
- More students involved in classroom management activity
- More students involved in testing
- More verbal interactions among students
- More adult commands, requests or direct questions to groups of students and to individual students not related to math
- More student responses not related to math
- More adult instruction of an individual student
- More adult acknowledgement of student comment or response
- One student is more often the adult communication focus
- Student more often makes an extended nonacademic response
- More student nonverbal communication

Configuration D

- Larger number of groups (see C for definition of group)
- Students more frequently have no adults present
- Adult more frequently in supervisory role
- Adult more frequently in observing role
- More individual student verbal interactions with adults
- More adult commands, requests or direct questions to individual students related to and not related to math
- More adult instruction of an individual student
- More adult acknowledgement of student comment or response

Figure 11 (cont.)

One student is more often the adult communication focus
More adult feedback to a student response to an adult command, request or direct question related to math
More student task-related comments to adults
Student more often makes an extended academic response

Configuration E

Larger number of groups
Students more frequently have no adults present
Adult more frequently in supervisory role
More students involved in nonacademic social interaction
More students involved in classroom management activities
More individual student verbal interactions with adults
More adult commands, requests or direct questions to individual students related to math
More adult intruction of an individual student
More students attentive to adult for math input
One student more often is the adult communication focus
More adult neutral and negative corrective feedback for behavior
More behavior control interactions
More student nonverbal communication

Configuration G

Teacher directs larger number of students
Teacher more frequently in observing role
Teacher observes more students
More students involved in testing
More adult commands, requests and direct questions to groups of students related to math
More student responses unrelated to math
More group instruction
More adult acknowledgement of student comments and responses
Adult more often attentive to students in general and small groups in particular
More adult feedback to a student response to an adult command, request or direct question related to math
The whole class is more often the adult communication focus
More student responses related to math

Configuration I

Teacher directs larger number of students
Larger percentage of students on task
More group instruction
More adult task-related comments to students

Figure 11 (cont.)

More attention related to math given to students by adults
More structuring or organizing by adult to students
More child nonverbal communication

configuration C is characterized by the teacher acting in many different roles and by a great deal of verbal interaction with and among students, both related and unrelated to math. Management activities often occur. This is associated with a configuration in which grouping patterns are continually changing, as are the materials being used, both based on student needs.

Configuration D is largely associated with behaviors characteristic of a one-on-one, individualized setting. There is a good deal of extended teacher-individual child interaction. Configuration E shares the behaviors expected of an individualized classroom. However, significantly more nonacademic activity is taking place, as reflected in classroom management activities and student social interactions. Behavior control is evident. Configuration I, on the other hand, appears much more structured, group-oriented and task-focused.

Research Question 3: What is the Relationship Between the Configurations of the Math Program and Variables that Teaching Effects Research Suggests Significantly Affect Achievement?

Teaching effects research indicates that certain classroom patterns and teacher behaviors tend to correlate with increased learning outcomes. One of these variables is the teacher's use of systematic instructional patterns, e.g., the teacher asks a question, child gives a response, teacher guides the child to correct response if wrong or acknowledges the response if correct. This systematic patterning was used by teachers who implemented configurations D and G. Interestingly, one of these configurations utilizes an individualized mode and the other a large-group mode. As assessed in the checklist, teachers using configuration D make immediate instructional decisions based on student needs (i.e., test results), while those in configuration G focus much more on group needs and "carry along" students who lag behind the group.

Another variable of interest to effects researchers is student task

persistence. In this study, students of teachers using configurations G and I were more often on-task than those of configurations C and E. Some of this student on-task behavior may result from the organizing and structuring behaviors characteristic of teachers in configuration I. Thus, it appears that in the more structured, group-oriented settings, with less teacher attention to individual children, on-task behavior is more likely.

A related variable is classroom management. Research indicates that when management activities take up too much class time, learning tends to suffer. Teachers using configurations C and E take more time for classroom management. Time is taken for behavior control in configuration E. Thus, it seems that the more individualized and flexible a setting the more likely a teacher will spend time in classroom management activities.

Unfortunately, in this study student achievement data were unavailable. Were they available, the full impact of the various configurations on student learning could be discussed and questions concerning the appropriateness and acceptability of the configurations of use evident in math instruction addressed.

Summary and Implications

A modification of the Stanford Research Institute's Classroom Observation Instrument was used to study the different adaptations, or configurations, made by teachers implementing a criterion-referenced mathematics program. The data derived from its use describe the dominant configurations in detail and suggest some interesting relationships between the strategies selected by teachers using the curriculum and the specific teaching behaviors practiced in the classroom. There also appeared to be some correlation between the configurations identified within this teacher sample and several variables recent research has found tend to affect student achievement.

The findings of this report suggest several implications for research,

evaluation, and staff development. First, the adaptations made to the SRI instrument provided specific, systematic, and diverse data about classroom organization, teacher and child behaviors. The expanion of Classroom Checklist information and changes in the Five Minute Observation codes allowed in-depth study of a single basic skills content area. This modified format would be useful to other researchers, and also to evaluators, interested in systematic observation of math instruction, and with minimal modification for other basic skills areas.

Another implication relates to the process for identification of innovation configurations refined through its use in this study. The correlation between the configuration patterns and classroom data suggests that configuration information derived from an interview-developed, teacher-completed checklist validly represents what is actually occurring in the classroom. Although observation data served to "flesh out" the teaching behaviors characteristic of each configuration, many of the general aspects of the configurations found by the checklist were confirmed.

A final implication is suggested by relating the configurations found in the sample to some of the variables research suggests affect student achievement. Any conclusion made from the present study must be highly qualified, since outcome data were not available for direct correlation. However, it appears that certain configurations foster behaviors believed to positively affect outcomes, and other configurations do not appear to foster such behaviors. Notably, the more individualized configurations find more teacher time spent on management rather than instruction, and less on-task behavior by students. This knowledge raises some interesting questions. The most obvious is whether indeed there are any outcome differences, which would necessitate correlations with outcome data. If predicted outcome differences are found, then there are

several important questions for facilitators of the program. Should teachers be allowed to adapt the innovation any way they please? Are there some critical components of the innovation that should not be adapted? If teachers are indeed allowed to make adaptations, should staff development focus on maximizing the effect of the adaptations? This last question has direct implication for the present study: teachers selecting individualized configurations probably need more training in management so that valuable teaching time is not wasted and students remain attentive to their work.

Innovation implementation in schools is far from being understood at this time. In the present study, classroom observation utilizing the modified SRI Classroom Observation Instrument contributed to understanding of teacher adaptation of innovations. Future analysis of these data and future studies of a similar nature promise meaningful contributions to understanding school change.

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